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Dataset Information:
Funding_Info: NOAA Climate Program Office; NOAA Ocean Acidification Program
Initial_Submission: 20150703
Revised_Submission: 20160130

Cruise Information:
Experiment Name: EX1427
Experiment Type: SOOP Line
Platform Type: Ship
Co2 Instrument Type: Equilibrator-IR or CRDS or GC
Cruise ID: 33KF20140717
Cruise Info: AOML_SOOP_CO2
Geographical Region:
  Westernmost Longitude: -74.1
  Easternmost Longitude: -63.0
  Northernmost Latitude: 40.7
  Southermost Latitude: 18.0
Cruise Dates (YYYYMMDD)
  Start_Date: 20140717
  End_Date: 20140726
Ports of Call:
  Bayonne, NJ
  Kings Wharf, Bermuda
  Phillipsburg, St. Maarten
  San Juan, Puerto Rico
  Labadee, Haiti
Vessel Name: Explorer of the Seas
Vessel ID: 33KF
Vessel Owner: Royal Caribbean International

Variables Information:
<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Description of Variable</th>
<th>Unit of Variable</th>
</tr>
</thead>
<tbody>
<tr>
<td>xCO2_EQU_ppm</td>
<td>Mole fraction of CO2 in the equilibrator headspace (dry) at equilibrator temperature (ppm)</td>
<td>ppm</td>
</tr>
<tr>
<td>xCO2_ATM_ppm</td>
<td>Mole fraction of CO2 measured in dry outside air (ppm)</td>
<td>ppm</td>
</tr>
<tr>
<td>xCO2_ATM_interpolated_ppm</td>
<td>Mole fraction of CO2 in outside air associated with each water analysis. These values are interpolated between the bracketing averaged good xCO2_ATM analyses (ppm)</td>
<td>ppm</td>
</tr>
<tr>
<td>PRES_EQU_hPa</td>
<td>Barometric pressure in the equilibrator headspace (hectopascals)</td>
<td>hPa</td>
</tr>
<tr>
<td>PRES_ATM@SSP_hPa</td>
<td>Barometric pressure measured outside, corrected to sea level (hectopascals)</td>
<td>hPa</td>
</tr>
<tr>
<td>TEMP_EQU_C</td>
<td>Water temperature in equilibrator (degrees Celsius)</td>
<td>Degree C</td>
</tr>
<tr>
<td>SST_C</td>
<td>Sea surface temperature (degrees Celsius)</td>
<td>Degree C</td>
</tr>
<tr>
<td>SAL_permil</td>
<td>Sea surface salinity on Practical Salinity Scale (permil)</td>
<td>ppt</td>
</tr>
<tr>
<td>fCO2_SW@SST_uatm</td>
<td>Fugacity of CO2 in sea water at SST and 100% humidity (microatmospheres)</td>
<td>μatm</td>
</tr>
<tr>
<td>fCO2_ATM_interpolated_uatm</td>
<td>Fugacity of CO2 in air corresponding to the interpolated xCO2 at SST and 100% humidity (microatmospheres)</td>
<td>μatm</td>
</tr>
<tr>
<td>dfCO2_uatm</td>
<td>Sea water fCO2 minus interpolated air fCO2 (microatmospheres)</td>
<td>μatm</td>
</tr>
<tr>
<td>WOCE_QC_FLAG</td>
<td>Quality control flag for fCO2 values (2=good, 3=questionable)</td>
<td>None</td>
</tr>
<tr>
<td>QC_SUBFLAG</td>
<td>Quality control subflag for fCO2 values, provides explanation when QC flag=3</td>
<td>None</td>
</tr>
</tbody>
</table>
Equilibrator Design:

- **Depth of Seawater Intake:** 5 meters
- **Location of Seawater Intake:** Forward port side, just above the bow thruster tunnel
- **Equilibrator Type:** Sprayhead above dynamic pool, with thermal jacket
- **Equilibrator Volume:** 0.95 L (0.4 L water, 0.55 L headspace)
- **Water Flow Rate:** 1.5 - 2.5 L/min
- **Headspace Gas Flow Rate:** 70 - 150 ml/min
- **Vented:** Yes
- **Drying Method for CO2 in Water:**
  - Gas stream passes through a thermoelectric condenser (~5 °C) and then through a Perma Pure (Nafion) dryer before reaching the analyzer (90% dry).
- **Additional Information:** Primary equilibrator is vented through a secondary equilibrator

CO2 in Marine Air:

- **Measurement:** Yes, 5 readings in a group every 3.2 hours
- **Location and Height:** On bow mast at ~20 meters above the sea surface
- **Drying Method:**
  - Gas stream passes through a thermoelectric condenser (~5 °C) and then through a Perma Pure (Nafion) dryer before reaching the analyzer (90% dry).
- **CO2 Sensor:**
  - **Measurement Method:** Infrared absorption of dry sample gas
  - **Manufacturer:** LI-COR
  - **Model:** 6262
  - **Frequency:** Every 140 seconds, except during calibration
  - **Resolution Water:** 0.01 microatmosphere
  - **Uncertainty Water:** ± 1 microatmospheres
  - **Resolution Air:** 0.01 ppm
  - **Uncertainty Air:** ± 0.2 ppm
- **Manufacturer of Calibration Gas:**
  - ESRL, Boulder - Std 1: Commercial UHP Nitrogen, 0.00 ppm / Std 2: CA04890, 282.59 ppm / Std 3: CC115007, 381.54 ppm / Std 4: CB09022, 537.45 ppm
- **Number of Non Zero Gas Standards:** 3
- **CO2 Sensor Calibration:**
  - The analyzer is calibrated every 3.2 hours using standards directly traceable to the WMO scale.
- **Other Comments:**
  - Instrument is located in the ship's air-conditioned bow thruster space. Ultra-High Purity nitrogen gas (0.0 ppm CO2) and the high standard are used to zero and span the LI-COR analyzer.
- **Method References:**
- **Details Co2 Sensing:**
  - details of CO2 sensing (not required)
- **Measured Co2 Params:**
  - xco2(dry)

Sea Surface Temperature:
- **Location:** In bow thruster room between the inlet and sea water pump
Manufacturer: Seabird  
Model: SBE-38  
Accuracy Degrees Celsius: 0.001  
Precision Degrees Celsius: 0.00025  
Calibration: Factory calibration  
Comments: Manufacturer's Resolution is taken as Precision; Maintained by other scientists.

Equilibrator Temperature:  
Location: Inserted into equilibrator ~ 5 cm below the water level.  
Manufacturer: Hart  
Model: 1523  
Accuracy Degrees Celsius: 0.015  
Precision Degrees Celsius: 0.001  
Calibration: Factory calibration  
Comments: Manufacturer's Resolution is taken as Precision.

Equilibrator Pressure:  
Location: Attached to equilibrator headspace  
Manufacturer: Setra  
Model: 239  
Accuracy hPa: 0.052  
Precision hPa: 0.01  
Calibration: Factory calibration  
Comments:  
Differential pressure reading from Setra-239 attached to the equilibrator headspace was added to the pressure reading from the Setra-270 on the exit of the analyzer to yield equilibrator pressure. Manufacturer's Resolution is taken as Precision.

Atmospheric Pressure:  
Location: On mast above bridge and atmospheric lab, ~59 m above sea surface.  
Manufacturer: R.M.Young  
Model: 61302V  
Accuracy: ± 0.3 hPa  
Precision: 0.15 hPa  
Calibration: Factory calibration  
Normalized: yes  
Comments: Manufacturer's Resolution is taken as Precision; Maintained by other scientists.

Sea Surface Salinity:  
Location: In bow thruster space, next to CO2 system.  
Manufacturer: Seabird  
Model: SBE 45  
Accuracy: ± 0.005 permil  
Precision: 0.0002 permil  
Calibration: Factory calibration  
Comments: Manufacturer's Resolution is taken as Precision; Maintained by other scientists.

Additional Information:  
The CO2 analytical system performed well throughout this cruise.

Preliminary Quality Control:  
NA
Form Type:

underway